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REMARKS

The present response is to the Office Action mailed in the above-referenced case on June 5, 2003. Claims 1-24 are pending for examination. The Examiner has rejected claims 1-24 under 35 U.S.C. 103(a) as being unpatentable over Eickemeyer et al., (U.S. 6,061,710), hereinafter Eickemeyer in view of Borkenhagen (U.S. 6,076,157), hereinafter Borkenhagen, and to Kalafatis (U.S. 6,535,905), hereinafter Kalafatis.

Applicant has carefully reviewed the prior art references cited and applied by the Examiner, and the Examiner's rejections and comments in the instant Office Action. In response, applicant provides argument to more particularly point out the subject matter of applicant's invention regarded as patentable, and to clearly establish that the claims in their present form distinguish unarguably over the prior art. Applicant points out and argues the key limitations of applicant's base claims, which the Examiner appears to have misunderstood in his rejections and statements.

The Examiner has stated that, regarding claims 1, 6, 11 and 16, Eickemeyer discloses substantially the limitations of applicant's claims, with the exception of expressly detailing a fetch algorithm, adding that since the Eickemeyer system predicted whether a branch path was taken or not using indicators such as availability of hardware context, it would have been obvious that the system of Eickemeyer used determination of whether a branch path was to be taken or not taken in at least one fetch algorithm for determining which thread was to be fetched.

The Examiner relies on Borkenhagen for teaching this deficiency, stating that Borkenhagen did not expressly detail that the predictor for switching threads or streams included whether a branch was taken. The Examiner stated that

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Kalafatis, however, specifically taught a switch on branch logic that used a scheme or algorithm that determined whether to switch threads depending on whether a branch was predicted as taken.

Applicant respectfully traverses the Examiner's interpretation of the prior art as reading on applicant's base claims, and argues that not all of applicant's limitations in the claims are specifically taught, suggested or intimated in the prior art. Specifically, applicant argues that the Examiner improperly relies upon Eickemeyer as a primary reference for combining with the remaining references to read on applicant's claims.

The Examiner has stated that Eickemeyer taught applicant's invention substantially as claimed including a branch predictor for forecasting whether a branch alternative of branch instructions will be taken (e.g., col. 8, lines 43-65), and that the system of Eickemeyer predicted whether a branch path was taken or not taken using indicators such as availability of hardware context (col. 11, line 53 - col. 12, line 64). Applicant respectfully disagrees with the Examiner's interpretation of Eickemeyer.

Applicant wishes to make it very clear to the Examiner that Eickemeyer does not predict whether a branch alternative of a branch instructions will be taken, as is specifically taught in applicant's invention. After careful and thorough review of the disclosure of Eickemeyer, particularly those portions cited and applied by the Examiner, applicant is confident that the teachings of Eickemeyer fall substantially short for a primary reference.

Applicant argues that Eickemeyer determines, at the point of a possible branch, which branch to pursue. Eickemeyer determines availability of hardware contexts, or streams, for servicing interrupts, and assigns the contexts to interrupts if the contexts are available. Upon arrival of an interrupt for servicing, the context availability for servicing the interrupt is determined through indicators, at the point of a possible branch, and if the context is available the interrupt is serviced, and if there is no context availability, an interrupt is serviced on a running thread

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context. Applicant argues that this is not predicting in any sense; rather, it is simple determination based on current indicators.

Applicant's invention, on the other hand, predicts considerably ahead of the point of a possible branch, which branch is most likely to be taken based upon past history. The branch predictor of applicant's invention is utilized to dynamically assign the streams. If there is high probability that a branch will not be taken, then the hardware streams that might have been utilized to load the context and pursue that branch would likely not be required for that purpose, and may therefore be allocated for other purposes. If the prediction made is incorrect, however, the stream is canceled and a context switch is performed for that stream, and the branch is then subsequently taken. Applicant's invention teaches interpreting high probabilities, and then planning the allocation of streams based upon said probabilities. A history is kept for each branch, and then the past history is used for predicting the future branch potential for availability for servicing an interrupt. For example, if a given branch has always been taken in the past, there is a high probability that the same branch will be taken again in the future, and, on the other hand, if the branch was taken twice, not taken five times, and then taken only once again, and so forth, in past history, the prediction made will have a low confidence level. The technique of applicant's invention is an improvement to the prior art systems of the references provided by the Examiner, by associating a confidence level to prediction. The confidence level helps the fetching algorithm, for example, in cases in which two or more predictors predicted a miss in the data cache and one is selected to be switched out. In this case, the stream with higher confidence level will be selected. Applicant argues that this is true prediction, not simply determination based on current indicators, as taught in Eickemeyer.

Applicant therefore believes base claims 1, 6, 11 and 16 or their clearly and unarguably patentable over the prior art, either singly or combined, as the prior art references failed to teach true branch prediction as argued above by applicant. Applicant's base claims 21 and 23 recite a method for fetching

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instructions from individual ones of multiple streams as instruction sources to a pipeline any multistream processor, and a similar method in a multistream processor having a data cache, both methods specifically reciting making a prediction by a branch predictor or hit/miss predictor, as to whether a branch will or will not be taken, or as to whether an instruction will hit the data cache. In view of applicant's arguments presented above on behalf of claims 1, 6, 11 and 16, base claims 21 and 23 are also patentable over the prior art either singly or in combination as argued above. Depending claims 2-5, 7-10, 12-15, 17-20, 22 and 24 are then patentable on their own merits, or at least as depended from a patentable claim.

It is therefore respectfully requested that this application be reconsidered, the claims be allowed, and that this case be passed quickly to issue. If there are any time extensions needed beyond any extension specifically requested with this amendment, such extension of time is hereby requested. If there are any fees due beyond any fees paid with this amendment, authorization is given to deduct such fees from deposit account 50-0534.

Respectfully submitted

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by


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